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File Code: 3420 **Date:** October 22, 2004
Route To:

Subject: Douglas-fir Beetle Activity in Rodeo-Chediski Fire (blackmesard)

To: District Ranger, Black Mesa RD

On September 29 through October 1, 2004, I visited with Brian Dykstra, Wildlife Biologist with the Black Mesa RD, to discuss bark beetle activity in Mexican spotted owl "Protected Activity Centers" (PACs) within the Rodeo-Chediski Fire perimeter. We also discussed methods for assessing the effectiveness of preventive treatments implemented on the District in 2004 to reduce bark beetle attacks within the PACs. I describe in this report past and current bark beetle activity within these PACs, preventive treatments that took place in 2004, results of monitoring Douglas-fir beetle flight periodicity, and make recommendations for the 2005 season. Additional information on Douglas-fir beetle biology was provided in last year's report sent to the District on October 30, 2003.

Background information

During my visit to the Black Mesa RD in September 2002, Gayle Richardson and I observed that crowns of all mixed conifer trees were completely consumed by fire within some of the PACs. In other PACs, medium and large-diameter Douglas-fir were significantly scorched (e.g., more than 50 percent of the crown and 100 percent of the lower bole were scorched). These trees are highly susceptible to attack by Douglas-fir beetle, *Dendroctonus pseudotsugae*. Where such susceptible trees are abundant, once they are infested and killed, beetle populations can build up rapidly and spread to adjacent stands (Schmitz and Gibson, 1996). There have been several documented cases of Douglas-fir beetle reaching outbreak status following fire scorch damage to Douglas-fir (Schmitz and Gibson, 1996).

Although a formal survey was not conducted in 2002, Douglas-fir trees infested with Douglas-fir beetle were found within the burn area. During our 2002 aerial detection survey conducted on the Apache-Sitgreaves NFs, more than 500 Douglas-fir beetle-killed trees were mapped. Because of unsuitable condition, we were not able to survey within the boundary of the Rodeo-Chediski Fire in 2002; however, several Douglas-fir mortality polygons were mapped just to the northwest of the fire boundary. Nearly 2,000 acres of Douglas-fir beetle activity was mapped across the Apache-Sitgreaves NF in 2003. Much of this activity occurred below and above the Mogollon Rim near the PAC sites of interest. During a brief ground survey conducted within the Rodeo-Chediski Fire boundary during September of 2003, I found scattered Douglas-fir beetle activity within areas of moderate fire intensity. These elevated rates of Douglas-fir mortality have continued throughout the Apache-Sitgreaves NF during 2004 with approximately 11,000 Douglas-fir killed across more than 7,000 acres.

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Preventive treatments to reduce Douglas-fir beetle activity

To take a proactive approach to prevent spread of this beetle within and from the burn area, we recommended the deployment of anti-aggregation pheromone for Douglas-fir beetle for 2003. The anti-aggregation pheromone (3-methylcyclohex-2-en-1-one [MCH]) serves to disrupt aggregation behavior of beetles (Schmitz and Gibson, 1996). MCH has been used experimentally to reduce the level of attack in high-risk areas (Ross and Daterman, 1994, 1995) and is now being used operationally to protect localized areas from being attacked by Douglas-fir beetle. A guide to the protocol for using MCH has been developed (Ross, et al., 2001) and was forwarded to the District.

The Black Mesa RD received Prevention/Suppression funding in the spring of 2003 for the deployment of MCH within the PAC sites. In late April through Mid-May of 2003, our office worked with the Black Mesa RD Wildlife unit to deploy MCH throughout selected PAC sites. Criteria for selecting PAC sites to be treated included percent of Douglas-fir in stand, level of crown and bole damage to Douglas-fir, and previous and current owl activity. MCH was deployed in a grid fashion in which bubble capsules were stapled to trees every 40 feet throughout the area to be protected. The District received additional Prevention/Suppression funds in 2004 and the MCH treatment was repeated in some of the PAC sites in April of 2004. The Coconino Rural Environment Corps (CREC) was contracted to put out the MCH in 2004 over an eight day period. However, because the MCH was not received by the District until nearly one week after the expected arrival date and because the CREC crew was only available for a brief period of time, not all of the PAC sites treated in 2003 were treated again in 2004.

Douglas-fir beetle activity in PAC sites in 2004

Brian Dykstra's staff conducted a thorough ground survey in the PAC sites treated with MCH the last week of August 2004. Effectiveness of the project was determined by the use of timber stand examinations and point-to-point transect observations. Stand examinations completed for the project were compliant with the USDA Forest Service Common Stand Exam Field Guide for Region 3. Three stand examination plots were completed in each PAC site. The first plot for each PAC was selected at random with the aid of a GIS system, the second plot in succession was placed 5 chains (330 ft.) from the first plot in a manner that would allow the plot to fall within the PAC. The third plot was placed 5 chains from the second plot in a similar fashion as the second plot.

The surveys were completed by a three person team. Each plot was surveyed for the following parameters: live trees were surveyed on a variable radius plot using a 10 basal area factor (BAF) and a breakpoint diameter of 5 inches DBH, dead trees must be 12 inches DBH and were surveyed on a 1 acre fixed radius plot (118 foot radius from plot center), and regeneration was surveyed on a 11.8 foot fixed radius plot. Two damage categories and agents were selected for each tree, if applicable.

Point-to-point transects consisted of the three person crews tallying the number of dead or dying Douglas-fir within transect. Transects were one chain wide (66 feet) and 5 chains (330 feet) long for a total area surveyed of ½ acre. Each crew member tallied the number of Douglas-fir encountered that had signs of Douglas-fir beetle attack: pitch tubes, fading foliage, orange frass, and/or beetle life stages (larvae, pupae, adults).

Based on these signs of attack, light (Horse Tank and Jersey Canyon PACs) to moderate (Cemetery PAC) Douglas-fir beetle activity was detected within the fire-scorched Douglas-fir located in the PAC sites (***Table 1***). It should be noted that initial entry/feeding by woodborers can create orange boring dust similar to that created by Douglas-fir. Only after woodborers enter the sapwood does the boring dust become white in color. Therefore, not all of the attacks reported in Table 1 are necessarily by Douglas-fir beetle. In addition, based on the protocol used for transects, one cannot determine if these trees were killed initially by fire damage or by Douglas-fir beetle.

Table 1. *Number of Douglas-fir trees showing signs of Douglas-fir beetle attacks in transects installed in each PAC site treated with MCH.*

PAC Site	DFB Attacks/Transect (mean)
Horse Tank 1A	0
Horse Tank 1B	0.5
Jersey Canyon 2A	2.5
Cemetery	13.5
Total	**4.13**

Douglas-fir beetle flight periodicity

Because no data existed for Douglas-fir beetle flight periods in Arizona, we began to monitor flight periodicity of beetles in 2004. Bark beetle flight periodicity is typically measured using Lindgren® funnel traps bait with beetle specific lures (Lindgren, 1983). Therefore, six 12-unit Lindgren® multiple-funnel traps were deployed in three pairs within the boundary of the Rodeo-Chediski Fire south of Highway 260. Traps were bait with a commercially available Douglas-fir beetle lure produced by Phero Tech, Inc. Beetles were collected from traps either weekly or every other week beginning in mid-April through early-September. Although beetle catches are still being counted, initial Douglas-fir beetle flight occurred between May 27th and June 3rd based on visual inspection of trap catches. The peak of Douglas-fir beetle flight occurred during the month of June. Douglas-fir beetle flight appeared to be completed by the third week of August. Large numbers of beetles were trapped during the peak of flight activity with some traps catching several thousand beetles in a two week period. Although additional years of flight monitoring are needed to account for year to year variability, the first year findings suggest that MCH treatments should be in place by the end of the third week of May. Furthermore, surveys designed to find newly attacked Douglas-fir should be completed in early September.

Recommendations for 2005

Based on the level of Douglas-fir beetle activity in and around the PAC sites of interest within the Rodeo-Chediski Fire perimeter, I recommend that the PAC sites be treated with MCH again in 2005. If possible, the MCH should be deployed no later than mid May. I will continue to work with Brian, his staff, and the CREC crew to purchase and set out the MCH. I recommend that we have a thorough discussion and training of identifying Douglas-fir beetle attacks prior to conducting the post-treatment surveys.

In addition, repeating the monitoring of Douglas-fir beetle flight periodicity will add to our knowledge of year to year variation in initial, peak, and completed flight periods. This information can also be used to make qualitative comparisons of Douglas-fir beetle populations between years.

Funds may be available for FY2005 from Forest Health Protection for preventing Douglas-fir beetle populations from increasing within the PAC sites on the District. Requests for these funds should be in no later than October 15, 2004.

If you have any questions regarding this assessment of the current beetle activity within the PAC sites, please let us know. I can be reached at (928) 556-2074.

/s/ Joel D. McMillin
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cc: Brian Dykstra, Gayle Richardson, Deb Bumpus, John Anhold, Debra Allen-Reid, Leonard Lucero, Kathleen Klein, Mailroom R3 Apache Sitgreaves

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